

## COMMENSAL RODENTS AND ECTOPARASITE CONTROL

By Joe E. Brooks

### A. What are the commensal rodents?

With the sole exception of man, the most successful and abundant mammals on earth today are the commensal rats and mice. They would never have enjoyed this success without man's inadvertent help. Commensal rodents have taken advantage of human transport and trade routes and in this way they spread from their ancestral homes in Asia to all the continents of the world.

What are the commensal rodents? Commensal refers to the fact that these animals live at man's expense, invading his home, eating his food and damaging his commodities; they are also capable of transmitting diseases to man, who thus derives no benefit from the relationship. Three species of worldwide occurrence are the most important of the commensal rodents: the Norway or brown rat, *Rattus norvegicus*, the roof rat, *R. rattus*, also called the black or ship rat, and the house mouse, *Mus musculus*.

### B. Where are they distributed?

The roof rat is primarily a rat of the tropical regions of the world (Appendix 1). Its ancestral home was probably the Southeast Asian mainland. From there it spread by way of shipping and caravan routes across the Indian subcontinent and into the Middle East. From there it was carried into Europe in the 11th or 12th centuries. Finally, it has been carried by ships to all the continents of the world: North and South America, Australia and into the South Pacific islands. It is still spreading into inland areas in Africa and the Pacific islands.

The Norway rat is primarily a rat of the temperate regions of the world (Appendix 2). Its ancestral home was the steppes of central Asia, now lying mostly within the borders of the Soviet Union. It spread much more slowly than the roof rat, moving mainly westwards, following the trade routes between China and Europe as they opened up in the 14th through 17th centuries. It didn't reach Europe until early in the 18th century, appearing first in some Baltic seaports and then rapidly spreading throughout Europe in the next 100 years. It was carried by shipping into most of the major seaports of the world during the next two centuries. It remains mainly restricted to seaport areas in much of the tropical world.

The house mouse was originally found in the area between Iran and the Soviet Union, living as a mouse of grassland areas. It has been spread around the world, mainly by ships. It now has the widest distribution of any animal except for man. It lives in the high latitudes of the Arctic, in Siberia, and is found on islands in the Antarctic Ocean. It lives not only in man's houses, villages, towns and cities, but occurs as a field rodent in many cropland areas.

### C. How are they identified?

The identifying field characteristics of the three commensal rodents are given in Appendix 3. Norway rats are stocky, medium to large-sized rodents and the tail is usually shorter than the head and body length. The snout is blunt, the ears relatively short and thick and the fur is coarse, being brownish-grey on the back and whitish-grey on the belly (Fig. 1). The female has 12 mammarys; three pairs in the groin and three pairs on the chest.

The roof rat is a moderate-sized, slender, agile rat. The black rat, which is a color variant of the roof rat, has a slate-grey to black colored back and a dark grey belly. Although the brownish-grey and the black color variants were earlier referred to as separate subspecies, this is no longer considered to be valid, with both color variants commonly occurring in the same litter. The snout is slender, the ears are large and thin and the eyes are prominent (Fig. 2). The tail is unicoloured and generally longer than the head and body length. The female has 10 mammarys; two pairs on the chest and three pairs in the groin, although an extra pair may occur on the chest on rare occasions.



Fig. 1. Norway rat.

The house mouse is a small slender animal with prominent eyes and ears (Fig. 3). It is quite variable in color and many different forms have been recognized. The ancestral stocks are generally the smallest forms and they have a tail considerably shorter than the head and body length. They live almost exclusively outdoors. Several forms have evolved living in close association with man and his dwellings. Commensal mice tend to be larger than the ancestral forms, the length of their tail being almost equal to that of the head and body. The belly color is dark grey, shading almost imperceptibly into the brownish-grey of the back. The female has 10 mammarys; three pairs on the chest and two pairs in the groin.

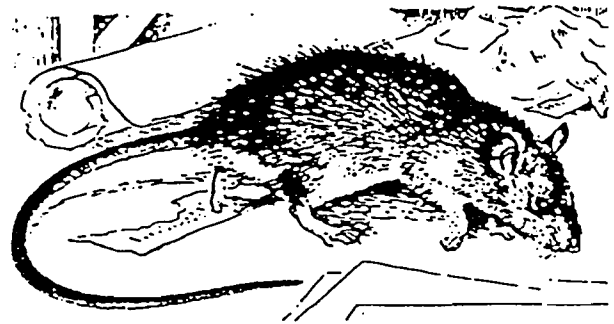


Fig. 2. Roof rat.

#### D. Biology and Ecology

Rats and mice are primarily nocturnal animals and need special skills in order to move about and find food and shelter in the dark. They have a keen sense of smell, continually moving their heads and sniffing when active. They use the sense of smell to locate food, in identifying friendly or unfriendly mice or other animals and in finding mates. They have a well-developed sense of touch, primarily through the use of the long whiskers on the snout called the vibrissae. They use the whiskers to warn them of voids and objects in the darkness and use the body hairs in order to maintain contact with the walls and floor. Rats and mice can hear sounds in the ultrasonic range, much higher than that of man. They can make sounds in the ultrasonic ranges also, which helps them locate young mice that have strayed from the nest or keep track of each other in the dark. The rat and mouse eye is specialized for nocturnal vision; it has high light sensitivity but poor visual acuity. They can detect motion very easily under very low-light conditions. The sense of taste is much more acute than mans; mice and rats can detect bitter, sweet or acidic substances in their food or drinking water in extremely small amounts, measured in 1 or 2 parts per million (ppm). This ability to detect very minute strange tastes is what helps them in avoiding poisons when they first encounter them.



Fig. 3. House mouse.

They have excellent physical abilities. The Norway rat is a prolific burrower, digging elaborate burrow systems in the soil. The roof rat and the house mouse have excellent climbing abilities, often living in the upper parts of houses and buildings. All can jump amazing distances for their size. Norway rats can jump vertically upward a distance of 70 cm and house mice can easily escape from a container 15 cm deep. They can drop a distance of 50 feet without harm. They are able to gnaw their way through wood, soft aluminium and soft brickwork and concrete. They have this ability because the incisor teeth grow continually and the outer layer wears away more slowly than the under layers, leaving a chisel-like cutting surface. All three commensal rodents are good swimmers and the rats can cross bodies of water like rivers and lakes.

They are mainly omnivorous, that is capable of eating a wide variety of foods. The Norway rat prefers cereal grains, meats, nuts, some vegetables, crustaceans and molluscs, roots and tubers and garbage. The roof rat feeds on nuts, seeds, fruits, field crops, sugarcane, coconuts, stored foods, insects and some meats. The house mouse will feed on most any stored food and causes field damage to maize, wheat, oats and other grains. It can live on the moisture content of the grain in storage facilities, having no need for a water source.

All three species are socially aggressive, being able to live in large colonies where the members known to each other get along tolerably well. However, adjacent colonies often will not tolerate members from other colonies, fighting with animals that wander over in their territory and running them off. They apparently recognize each other by a common odor which the stranger lacks.

They have a brief period before becoming sexually mature. In the house mouse it is 42 days, in the roof rat 68 days, and in the Norway rat is 75 days. The gestation period is short, 19 to 23 days and the young are weaned in 21 to 28 days. Litter size ranges from 6 in the house mouse to about 9 in the Norway rat and the number of young per year is in the order of 35 to 45 per female. These are considered high reproductive production figures and the commensal rodents are capable of rapid population growth when conditions are favorable.

Rats and mice live very short lives. The average life expectancy for house mice is in the range of 100 to 150 days (3 to 5 months), and for Norway rats and roof rats, most of the animals rarely live 8 months to a year before dying.

#### **E. How do they affect man?**

The commensal rats and mice have had a profound effect upon man. They brought the plague, called the Black Death, upon Europe in the 14th Century, killing between one quarter and one third of the then existing population before the disease ran its course. Besides plague, they spread murine typhus and rickettsialpox through their mites and fleas, leptospirosis through their urine and rat-bite fevers through their salivary secretions. They can contaminate our foodstuffs with bacteria that produce salmonellosis, a form of food-poisoning. They spread internal parasites, such as tapeworms, nematodes, cestodes, and protozoa, which can contaminate food and water.

They cause economic losses of stored foods throughout the world. Here in Pakistan, the common mouse in food storage facilities is the house mouse and it also occurs in farmers housing as an unwanted guest. The common rat in food storage facilities, grain markets and farmers houses is the roof rat. The Norway rat in Pakistan is restricted almost entirely to Karachi and a small population is reported to occur in the vicinity of the railway station at Lahore. The economic losses caused by commensal rodents in food storage facilities in Pakistan is fortunately low, but in many other parts of the world they are thought to destroy billions-of dollars worth of stored foods.

Besides the losses of stored foods, are the damage to mans' structures, fiber and fabrics. The commensal rodents gnaw their way through barriers to obtain food and shelter, damaging doors, windows, walls and floors. They destroy storage bags, clothing, furniture, books, cartons, soap and

other commodities. They burrow into railway embankments, causing rails to sag, and ditches and dikes to wash out. They are known to start fires inside walls by gnawing on electrical wires and making short circuits. They damage expensive electrical equipment by gnawing the insulation off the wires, causing it to short out or burn up.

#### F. Ectoparasites of Commensal Rodents

The ectoparasites of commensal rodents are fleas, lice, mites and ticks. The most important ones are fleas and mites, since these transmit the organisms causing plague, murine typhus, scrub typhus and rickettsialpox.

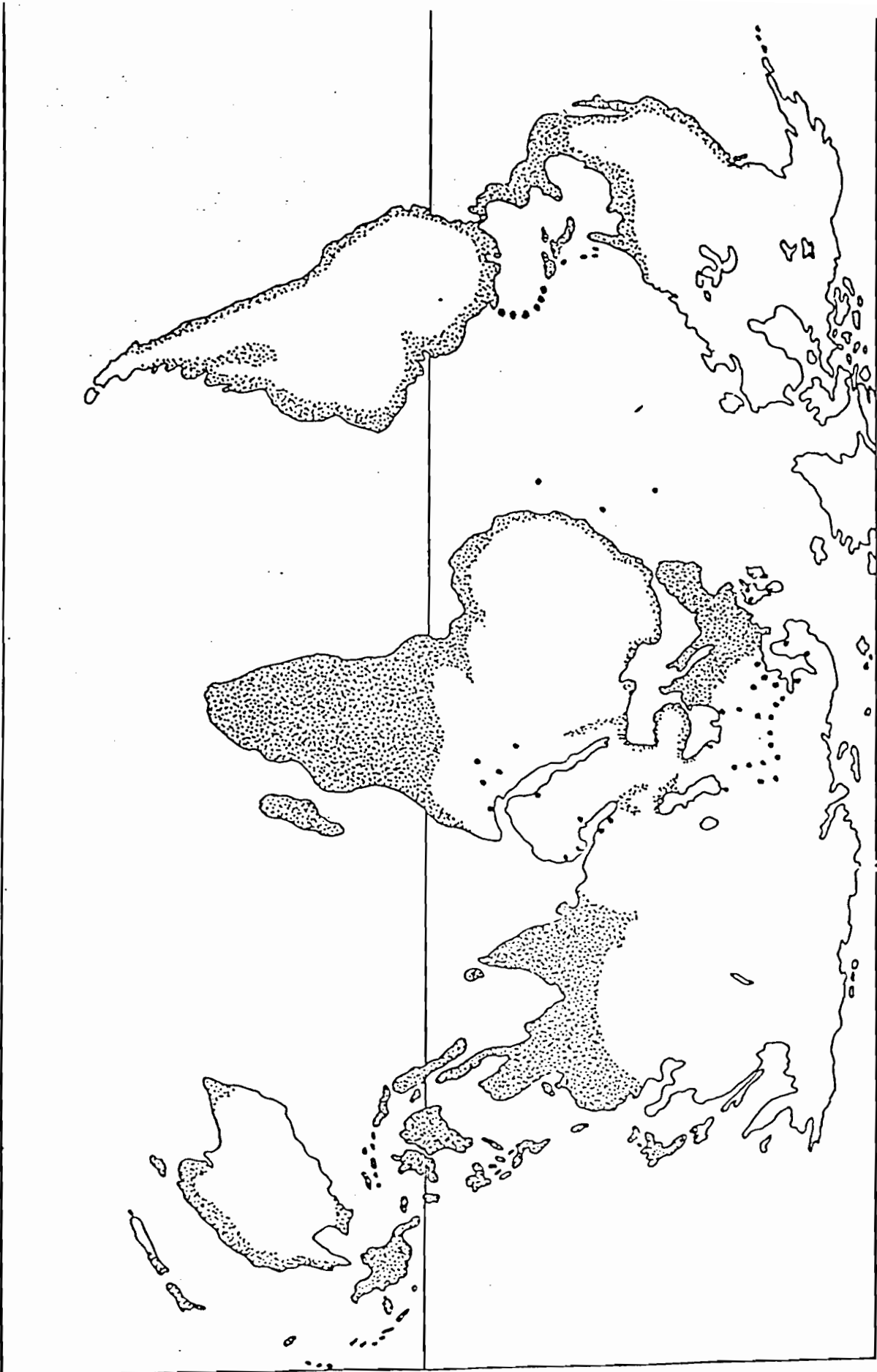
The common fleas of rats and mice are given in the *Quick Guide to Common Fleas*, attached at the end of this article. The most important from a disease standpoint are the two species of *Xenopsylla*; *X. cheopis* and *X. astia*, both of which are capable of transmitting plague and murine typhus through their bites.

Several mites are of disease importance: the house mouse mite, *Allodermanyssus sanguineus*, which transmits rickettsialpox and several species of mites known as chiggers, *Leptotrombidium* species, which transmit scrub typhus.

#### G. Ectoparasite Control

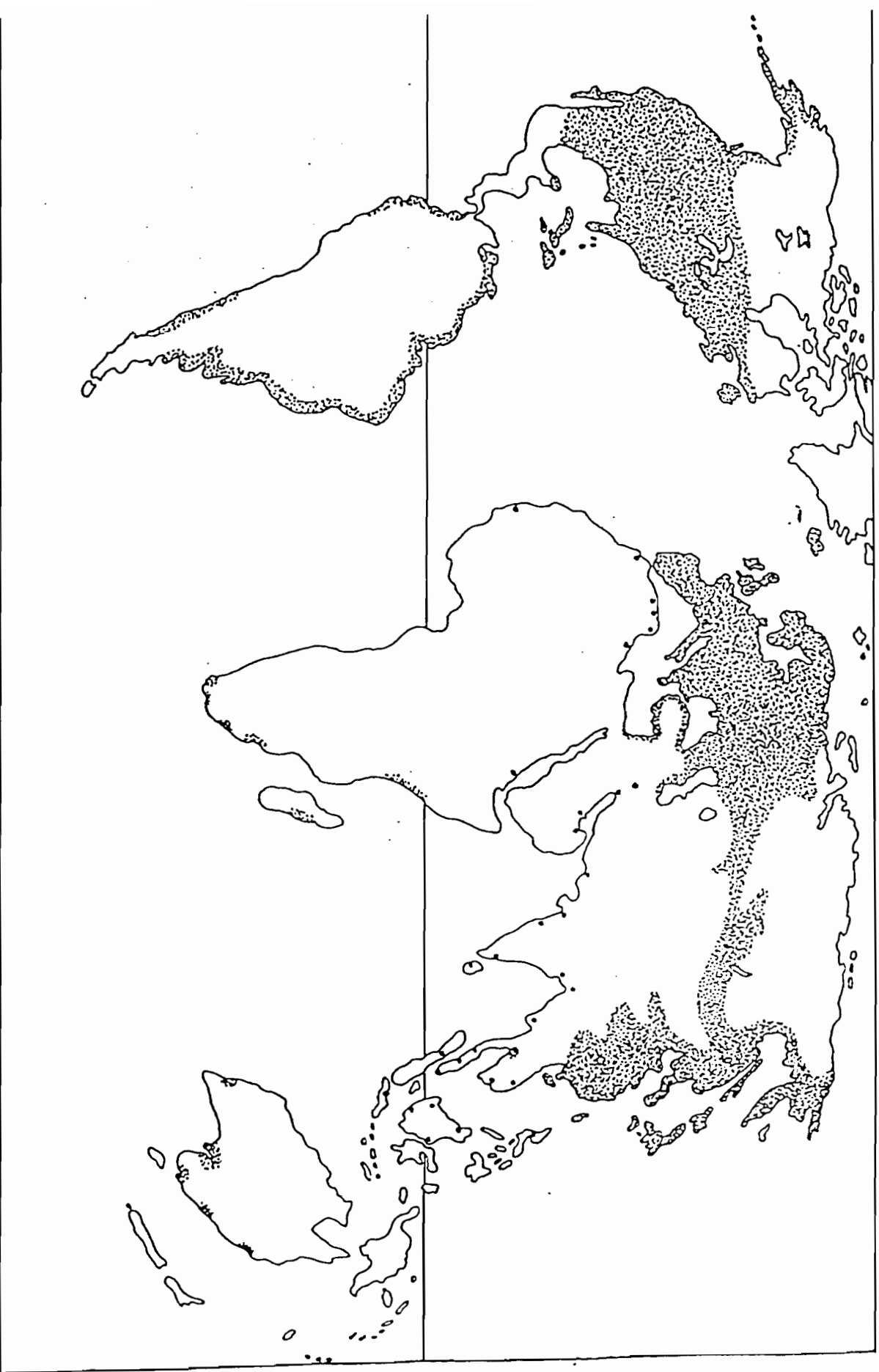
Control of ectoparasites (fleas, lice, mites and ticks) is essential to prevent transfer of rodent diseases to man. Ectoparasites feed on the blood of their rodent hosts and can thereby become infected. When the hosts are killed by trapping or poisoning, their ectoparasites sometimes, by chance, select a person as temporary host. If the ectoparasites are infected, they may transfer the disease-causing organisms to that person. When disease is thought to be present in a rodent population, ectoparasites should be killed before or concurrent with rodent control measures. To carry out ectoparasite control:

1. Inspect the area for signs of rat or mouse activity, especially for rubmarks at the base of walls and for evidence of pathways and burrow openings.
2. Select an appropriate insecticide for ectoparasite control. Since it is mainly fleas that are to be controlled, use either 5% carbaryl, 5% malathion, 1% propoxur, 2% fenitrothion or 2% pirimiphos methyl.
3. Treat all runways and burrow openings with one of the insecticidal dusts mentioned above. Dust the vertical surfaces against which rodents may brush, using a dust gun or hand shaker. When anticoagulant baits are laid in bait stations, apply insecticidal dusts at the openings to the stations.
4. Rats that come into contact with the insecticide dust carry it on their feet and fur into their burrows and nests. Fleas are normally killed within 48 hours following dusting.



Appendix 1. Distribution of *Rattus rattus*.

Appendix 2. Distribution of *Rattus norvegicus*.



APPENDIX-3: FIELD CHARACTERS AND MEASUREMENT OF COMMENSAL RODENTS

Character	Norway rat	Roof rat	House mouse
Weight	150-600 gm	80-300 gm	10-21 gm
Head and body	nose blunt, heavy, stocky body, 18-25 cm	nose pointed, slender body, 16-21 cm	nose pointed, slender body, 6-10 cm
Tail	shorter than head plus body, darker above and lighter below, with short, stiff hairs, 16-21 cm	longer than head plus body, uniformly dark coloured, naked, 16-25 cm	equal to or little longer than head plus body, uniformly dark coloured, naked, 7-11 cm
Ears	relatively small, close-set, appeared half buried in fur, rarely over 20-23 mm	large, prominent, thin and hairless, stand well out from fur, 25-28 mm	prominent, large for size of animal, 15 mm or less
Fur	brownish-grey on back, greyish on belly	brownish-grey to blackish on back, belly may be white, grey or greyish-black	one subspecies brownish-grey on back, greyish on belly, another greyish on back and greyish-white on belly
Habits	burrows, swims and dives easily, gnaws, lives indoors and outdoors, in sewers and drains	agile climber, gnaws, often lives off the ground in trees, shrubs, etc., lives indoors and outdoors	climbs, sometimes burrows, gnaws, lives indoors and outdoors

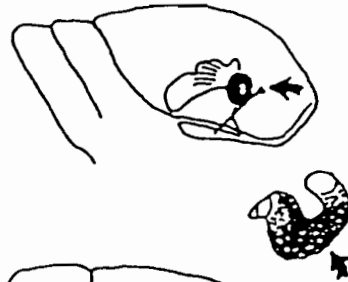
# A QUICK GUIDE TO COMMON FLEAS

Pronotal and genal  
combs absent  
Front margin of  
head with two  
angles



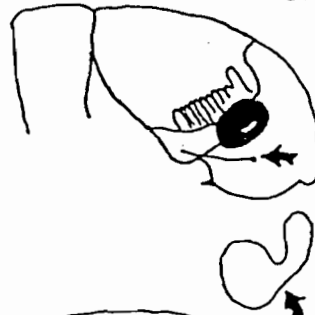
ECHIDNOPHAGA  
gallinacea

Front margin of  
head rounded,  
ocular bristle in  
Spermatheca in  
female partially  
pigmented



XENOPSYLLA  
cheopis  
astia  
brasiliensis  
vexabilis

Front margin of  
head rounded,  
ocular bristle  
below eye,  
Spermatheca in  
female unpigmented



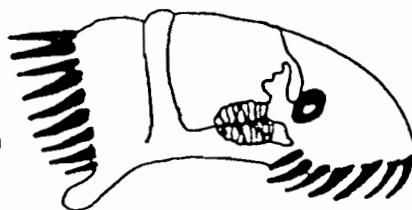
PULEX  
irritans

Pronotal combs only



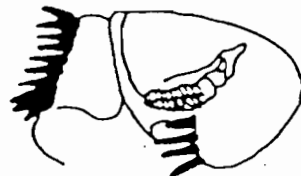
NOSOPSYLLUS  
fasciatus

Pronotal and genal  
comb present  
Genal comb with  
more than 5 teeth



CTENOCEPHALIDES  
felis  
canis

Genal comb with  
only 4 teeth,  
eye absent



LEPTOPSYLLA  
segnis